Aiming device for inserting angle-stable, long screws in the articular region of a bone

The invention relates to an aiming device for inserting angle-stable, long screws in the articular region of a bone for optimal treatment of joint fractures with plate/screw systems, using a distal humerus as an example.

For example, the patents US-20020032465-A1, US-20030220651-A1, US-4625718, US-4848327 and WO-03041595-A1 may be mentioned in relation to the prior art.

However, US 2003/0009171 A1 will be discussed in particular. This discloses a multiplicity of aids for fitting an elbow prosthesis, in particular an aiming device for drilling the articular region of the bone along its joint axis. This aiming device consists of a bow which is clamped on the articular region by means of a screw spindle. A guide zone for inserting a drill into the articular region along said joint axis is integrated in the screw spindle. The bore which can be produced in this manner serves here for inserting a pin which subsequently permits alignment of the elbow prosthesis and is then removed again. The insertion of a screw is not envisaged in this apparatus.

Even if this device disclosed in US 2003/0009171 A1 is intended for a completely different purpose, the preparation of bores therewith which is intended by the inventor could in certain circumstances be carried out,

even if with considerable disadvantages. The known device has no possibility for preventing the risk of penetration into the joint, which is also unimportant in the course of fitting an elbow prosthesis since the joint is removed in any case and is replaced. However, during osteosynthesis, treatment of the bone in as gentle a manner as possible is a precondition. As already mentioned, the placing of the distal screw required in osteosynthesis after drilling is complete is possible only if the device or at least the screw spindle were to be removed. However, this would eliminate the compression produced by the device for ensuring cohesion of any bone fragments. During the entire course of the operation with this known device, continuous stability is therefore not possible. Finally, the drill would disadvantageously have to have at least the length of the screw spindle and of the desired drilled hole, with the result that increased vibrations may adversely influence the drilling.

It is the object of the present invention to eliminate these disadvantages.

It should be possible by means of the invention to insert distal screws which are as long as possible through the bone in that region of the articular block which is in the vicinity of the joint, for which purpose the bores are accordingly to be introduced in a targeted manner and without any penetration into the joint, with the result that, after insertion of a screw, optimal fixation in the good bone should be achieved. Any screws opposite to one another should

moreover be capable of being brought past one another as closely as possible in a targeted manner and approximately along an axis without collision. This should be ensured in particular directly during the first attempt in order to protect the bone as far as possible. The compression of the bone fragments of the articular block during the entire duration of the operation is also to be maintained in order thereby to ensure a stable connection and good clinical results.

The aiming device according to the invention and according to Claim 1 consists of a bow, optionally having various cut-outs for weight reduction, and achieves the objects set. A preferred embodiment has the following design, a screw spindle which can be actuated by means of a nut and is intended for fixing the aiming device on the articular region of the bone is provided on the bow. A cylindrical guide which in turn bears an adaptor bush so as to permit rotational movement is mounted on the opposite end of the bow. Cylindrical guide and adaptor bush are suitable firstly for guiding a bone screw and secondly for bearing a drill bush having preferably an external thread. A target plate for connection to a bone plate is intended for producing a temporary plug connection with the adaptor bush of the aiming device.

Course of the operation

Before the operation, the target plate is screwed to a lateral implant (bone plate). By means of the plug connection, the target plate with the lateral implant

is mounted on the adaptor bush of the aiming device. The drill bush is then inserted into the orifice in the cylindrical guide and, passing through the adaptor bush and the target plate, comes into contact with a complementary internal thread in a bore of the implant. Everything is now placed together on the fragmented bone, clamped by the screw spindle of the aiming device and fixed with a proximal bone screw through the implant. With the aid of the aiming device according to the invention, it is therefore possible to determine the point of emergence of the distal, angle-stable screws prior to drilling. When everything is correctly aligned, drilling can be effected through the integrated drill bush. Furthermore, the length of the screw to be used and hence the depth of the hole to be drilled can be determined directly using the aiming device, in particular with reference to the scale mounted on its screw spindle.

After removal of the drill bush screwed to the implant, the compression persists via the plug connection between adaptor bush and target plate. This is an important advantage in contrast to the known device. By using the target plate, it is therefore possible, after removal of the drill bush, to screw in the screw while the aiming bow is mounted, i.e. under compression. The removed drill bush now also frees the larger diameter required by the bone screw. The bone screw fits firmly with its head on the same implant thread which the drill bush has previously held. In addition, the alignment of further screws is simplified in that the position of the already inserted screw is

indicated by the aiming device so that they are inserted in a completely targeted manner parallel to the joint axis and through the best bone of the distal part. When this has been completed, the aiming device and the target plate can be removed.

Further developments of the invention are shown in the Figures and indicated in the independent patent claims.

The list of reference numerals is part of the disclosure.

The invention is explained in more detail schematically and by way of example with reference to figures.

The figures are described in relation to one another and as a whole. Identical reference numerals denote identical components, and reference numerals with different indices indicate functionally identical or similar components.

Fig. 1 shows an aiming device according to the invention, having a separate drill bush and target plate, in the frontal view,

Fig. 2 shows the aiming device according to Fig. 1 with mounted drill bush and target plate, in frontal view,

Fig. 3 to 5 show the target plate according to Fig. 1 and 2 alone, in three different views,

Fig. 6 shows a schematic diagram of the aiming device with mounted drill bush, target plate and implant screwed thereto, as mounted on the humerus, in perspective view, and

Fig. 7 shows a schematic diagram of the humerus with implants and bone screws in the frontal plane.

Fig. 1 shows an aiming device 100 having a separate drill bush 140 and target plate 200. The target plate 100 consists of a U-shaped bow 110 having various cut-outs 112. A screw spindle 130 adjustable by means of a nut 132 is mounted on the lower end of the bow 110. A rotationally movable pin 131 is arranged on one end of the screw spindle 130. A scale 133 is mounted on the screw spindle 130. A cylindrical guide 111 which in turn bears an adaptor bush 120 in a rotationally movable manner is arranged on the upper end of the bow 110. Cylindrical guide 111 and adaptor bush 120 have an internal diameter which is suitable firstly for guiding a bone screw (not shown) and secondly for bearing a drill bush 140. This drill bush 140 is equipped at its end with a drill bush thread 141 which, when an implant (not shown) is used, engages said implant. The adaptor bush 120 is equipped with a snap element which finds its counterpart in a bore 220 of a target plate 200. The target plate 200 is therefore intended for producing a temporary plug connection to the aiming device 100, as shown in Fig. 2.

Fig. 2 shows the aiming device 100 with mounted drill bush 140 and target plate 200. The target plate 200 has a plug connection to the adaptor bush 120 described in Fig. 1. The drill bush 140 is inserted into the orifice in the cylindrical guide 111 and, on passing through the adaptor bush and the target plate 200 appears with its drill bush thread 141.

Fig. 3 to 5 show the target plate 200 in three different views. Said target plate has a bore 220 for the adaptor bush (not shown) which can thereby produce a plug connection to the target plate 200. Furthermore, three bores 210 for anterior-posterior bone screws are formed, one bore 230 for a target plate screw and three bores 240 for Kirschner wires.

Fig. 6 shows a schematic diagram of the aiming device 100 with mounted drill bush 140, target plate 200 and lateral implant 410a screwed thereto, as mounted on the articular block 310 of the humerus 300. The instrument set is therefore mounted as described in Fig. 2, the lateral implant 410a additionally being screwed on the one hand by means of a target plate screw 520 through the bore 230 shown in Fig. 3 to 5 and intended for the target plate screw (not visible) to the target plate 200. On the other hand, a thread (not shown) of the lateral implant 410a engages the drill bush 140, in particular its drill bush thread 141, which passes through the adaptor bush 120. The entire structure is clamped on the articular block 310 of the humerus 300 by the screw spindle 130 actuatable by means of the nut 132 and is anchored in the humerus 300 by means of a

proximal bone screw 510a through the implant 410a.

Fig. 7 shows a schematic diagram of the humerus with implants and bone screws in the frontal plane. The lateral implant 410a is fixed by means of proximal 510a, distal 510c and anterior-posterior 510e bone screws. The medial implant 410b is fixed by means of proximal 410b and distal 510d bone screws. In particular, the bone screws 510c and 510d are chosen to be as long as possible without penetrating into the joint and are guided past one another as closely as possible.

List of reference numerals

100 - Aiming device
110 - Bow
111 - Cylindrical guide
112 - Cut-out
120 - Adaptor bush or contact element
130 - Screw spindle
131 - Pin
132 - Nut or rotary grip
133 - Scale
140 - Drill bush
141 - Drill bush thread
200 - Target plate
210 - Bore for anterior-posterior bone screw
220 - Bore for adaptor bush
230 - Bore for target plate screw
240 - Bore for Kirschner wire
300 - Bone (humerus)
310 - Articular block (of the humerus)
410 - Implant
410a - Lateral implant
410b - Medial implant
510 - Bone screw
510a - Proximal bone screw (lateral)
510b - Proximal bone screw (medial)
510c - Distal bone screw (lateral)
510d - Distal bone screw (medial)
510e - Anterior-posterior bone screw
520 - Target plate screw